Research Article

Participatory Variety Selection in Increasing the Availability and Diversity of Improved Faba Bean (*Vicia Faba L*) Varieties in Some Selected Woredas Of Arsi Zone

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Abstract

The experiment was carried out in Hexosa, Munessa, Digalu Tijo and Cholle districts of Arsi Zone with the objectives of enhancing production and productivity of faba bean on farmers' fields and to improve linkage among stakeholders and create awareness on improved faba bean varieties and indirectly decreasing the cereal mono-crops systems of the areas. Four kebeles farmers training center were selected purposively based on faba bean production potential. Consequently, Oda jila kebele from Hexosa, Chaffa from Munessa district, Haro bilalo from Digalu tijo and Amuma salam bar from cholle district were selected. All management practices were done at the levels of local farmer's levels for eight improved and one locally available faba bean varieties were shown and evaluated. The experiment was established on 25 m^2 Demonstration Plots and DAP 100 kg/ha at the time of sowing applied to each demonstration plot with recommended seed rate. Both quantitative and qualitative data was collected through observation, group discussion on field day and data recording sheet. The significances of improved varieties along with local variety were also analyzed through SAS-software. While qualitative data were analysed through simple ranking and summarization. The result of the study indicated that the best varieties namely Gebelcho, Moti and Degaga were frequently selected as top ranking in all districts as final selections or adapted varieties. Therefore, these varieties are recommended for further popularization and scaling up in study area and similar agro ecology.

Keywords: Faba bean; Demonstration; Varieties

Introduction

Faba bean is the first most important pulse crops produced in Ethiopia both in terms of area coverage and annual production (CSA, 2018/19). It is grown at an altitude range between 1800-3000 masl, in place at the soil and weather are considered to be congenial for better growth and development of the crop. According to (FAO, 2017), in Ethiopia about 343,107.88 hectares of land annually covered in Faba bean with estimated production of 6,389,438.97 quintals. In Ethiopia, faba bean is the leading source of protein for the small holder farmers and used to make a number of traditional dishes. Moreover, the crop is source of income for producers either locally and foreign exchange for the country. It has also a line share on improving soil fertility through fixing atmospheric nitrogen and. In Arsi zone, Faba bean is cultivated in mid highland to highlands of the region occupies about 54.4% hectares of land annually with estimated production of 58.5% quintals from a total of pulse crop (CSA, 2019/2020). The regional (23.5 qt/ha) average yield of faba bean has remained low (CSA, 2019/2020). Even though the crop has a number of potential uses, the productivity of the crop is far below the potential and is constrained by use of traditional practices including unimproved farmer cultivar, poor agronomic practices, prevalence of insect pests and diseases and declining of soil fertility. However, crop production under varied agro-ecological conditions of the country would require modern varieties that fit to diverse ecologies. Individual farmers as well as Community based Seed Producer Cooperative farmers are highly demanding better yielding varieties to maximize their product and improve the livelihood of their families. Participatory Varietal Selection (PVS) has been proposed as an option to the problem of fitting the crop to both target environments and users' preferences. Moreover, it is worth mentioning that there are sound scientific and practical reasons for farmer involvement to increase the efficiency and the effectiveness of a breeding program Therefore the present study geared to words identifying high yielding improved faba bean varieties adapted to the selected districts that are acceptable to farmers in study areas.

Materials and Methods

In the present investigation eight released faba bean varieties with local checks were evaluated in 2016/2017 at four Woredas; Hexosa(Oda jila FTC), Digalu Tijo (Haro bilalo FTC), Munessa(Caffa FTC),Cholle (Akiya FTC) and Cholle(Amuma selam bar FTC) in which all locations are found in Arsi, south eastern Ethiopia. All locations were representing highland areas with variable soil type i.e., dark clay-loam, clay-loam, loam Clay loam and clay loam respectively. The trial was laid down in a single plot of 5m x 5m size. Each variety was planted in rows with spacing of 0.4m between rows and 1m between plots. DAP fertilizer was applied at the recommended rate of 100 kg/ha at sowing. Seed rate of 200 kg/ha was used. Eight released faba bean varieties including Gora, Tumsa, Gebelcho, Dosha, Moti, Obse, Degaga and CS20DK, and one farmer cultivar (local check) was used for the study to seek farmer's preferences through participatory variety selection. Both quantitative and qualitative data were collected through observation, group discussion on field day and data recording sheet by researchers' groups and farmers separately. Data like farmer preference on disease and pest's resistance, early maturity, drought tolerant, grain color, and yield data were collected through the prepared data collection sheet/record sheet by organizing mini field day and observation on farmer's field. Invited participants were gathered at the host farmers' field to assess the faba bean varieties at flowering stage, at maturity and at harvest, assisted by scientists, assistants from Kulumsa Research Center and agricultural experts from each Woredas. Out of the 113 participants at districts 27 were women (24%). During the evaluation farmers assembled to discuss what they thought were the important criteria for selecting a given variety at a particular development stage. Each criterion was scored from 1 to 5 (1 =Excellent, 2 = very good, 3 = moderate, 4 = bad and 5 = worst) for each variety. Participant farmers were also asked to give an overall score to each variety. Farmers were selected among participants at each district to evaluate varieties from the PVS trials. Each of the randomly selected farmers were given eight faba bean varieties and oriented to manage all plots equally. Farmers assessed the varieties at flowering and maturity and at harvest. At maturity, farmers scored each variety for earliness, seed per pod, and pods per plant; at harvest varieties were scored for seed size, grain color, straw yield and grain yield. Again, scores were given on a scale from 1 (excellent) to 5 (worst). At maturity and harvest, farmers were asked to give an overall assessment of each variety, using the same scale.

Data Analysis

SAS-software analyses were used for the crop performance concerning yield and yield components of the experiment harvested from PVS plot. Improved varieties along with local variety were also compared. While qualitative data were analyzed through simple ranking and summarization.

Results

Evaluation of Researchers

Mainly researchers' evaluation was focuses on the yield status of all considered faba bean varieties across location in which the varieties shown a distinct statistical variation in grain yield that was significant difference among the faba bean varieties in each location (Table 1). Accordingly, at Hexosa district the highest yield were recorded for faba bean variety Gebelcho (4011kg/ha), Gora (3891kg/ha) and Dosha (3867kg/ha) whereas, the lowest yield were recorded for local check variety (1976kg/ha). At Munessa district, the highest yield were observed for faba bean variety Degaga(3912kg/ha), Moti(3867kg/ha) and Gebelcho (3621kg/ha) but the lowest yield were recorded for local check variety (2213kg/ha). At Digalu Tijo district, the highest yield were observed for the faba bean variety Gebelcho (4123kg/ha), Dosha (3866kg/ha) and Degaga (3758 kg/ha) while the lowest yield were recorded for nearby available faba bean variety as a local check with (2613kg/ha). Finally, at Cholle district the highly yielded faba bean varieties are Degaga (3853kg/ha), Moti (3704kg/ha) and Dosha (3441kg/ha) while the lowest yield were recorded for local variety (2333kg/ha) respectively. In conclusion the faba bean varieties like Gebelcho, Dosha and Degaga showed a stable yield performance across all location which put them prior rank, while the faba bean varieties used as a local check at each district and CS20DK were poor yield performance at all location that revealed the progressive improvement of yield and a wider adoption scope of faba bean varieties in Ethiopia. Similar works are reported for some improved faba bean varieties those showed a good performance in both yield and adoption rate across different location by [1,2,3].

Table 1: Lists of faba bean varieties.

Variety	Year of release (G.C)	Days to maturity	Seed size(gm)	Adaptation status
CS20DK	1977	145-160	521	Nationally released
Degaga	2002	116-135	524	Nationally released
Moti	2006	108-165	763	Nationally released
Gebelcho	2006	103-167	745	Nationally released
Obsi	2007	87-166	722	Nationally released
Dosha	2009	120-130	665	Nationally released
Tumsa	2010	121-176	744	Nationally released
Gora	2013	126-168	938	Nationally released
Local check	-	-	371	Locally available

Farmers' Variety Evaluations

Farmers being the end-users of agricultural technologies are the primary beneficiaries in a participatory variety selection program. The researchers benefit from the participatory variety selection process also in the form of a feedback that helps them to re-orient their research program to better meet farmers' needs. Selection was carried out at three different growth stages by organizing a field day at each stage i.e at vegetative, flowering and physiological maturity. Representative farmers from the study area were participated and evaluated the participatory variety selection trial. Mainly farmers are more interested on additional demands (taste, cooking quality, amount of straw, height, performance under direct seeding, under suboptimal management conditions, weed competitiveness) and stand strength (lodging resistance), number of pod, number of seed, length of pod, maturity, chocolate spot resistance, aphid resistance, seed size, leaf shading, seed color and grain yield during selection process. The evaluations mean preferences of the farmers score values for each variety were ranked in (Table 2). Therefore, at Hexosa district, farmers are more preferred faba bean variety Gora (3891kg/ha) as a first rank with an exceptional traits of large seed size. It is followed by faba bean variety Gebelcho (4011kg/ha) and Moti (3611kg/ha) as a second and third rank for pod per plant and adoptability to the areas. Irrespective of this, the faba bean variety considered as a local check (1976kg/ha) was ranked at the end in this district but they preferred the tests during a fresh conception. At Munessa district the front line faba bean variety ranks are Moti (3867kg/ha), Degaga (3912kg/ha) and Gebelcho (3621kg/ha) with their respective orders and while the faba bean used as a local check (2213kg/ha) from this district was selected at last ranks. In overall all participants are satisfied with the adaptabilities of all considered faba bean varieties even if they are varied in some individual's farmer's criteria. Faba bean varieties like Gebelcho(4123kg/ha), Degaga(3758kg/ha) and Dodha(3866kg/ha) are orderly ranked while faba bean varieties CS20DK (3071kg/ha) is less preferred by farmers among the considered varieties specially due to less adopted to the area (Digalu tijo) district. In further, the highly preferred faba bean varieties by farmers at Cholle district were also Gebelcho (3422kg/ha), Moti(3704kg/ha) and Degaga 93853kg/ha) with their respective orders whereas, faba bean varieties CS20DK (2986kg/ha) were stumpy preference behind farmers due to less adopted, small seed size, chockolate spot occurrence and pod per plant accommodation as compared to the other varieties. In General, the best varieties namely Gebelcho, Moti and Degaga were selected as top ranking in all districts as final selections or adapted varieties. The same varieties had better performance and found to be promising from the analysis of researchers' collected data. In line to this finding [2-5]. stated that some nationally released faba bean varieties like Gebelcho, Gora, Dosha was the primary ranked variety by farmers selection.

Table 2: The mean performance of faba bean varieties across location and the ranks.

Variety	Grain yield (Kg/ha)				Rank given by researcher				Rank given Farmers			
	Hexosa	Munessa	Digalu Tijo	Cholle	Hexosa	Munessa	Digalu Tijo	Cholle	Hexosa	Munessa	Digalu Tijo	Cholle
CS20DK	3573^b	3221^d	3071e^d	2986^c	7	8	8	8	9	8	9	9
Degaga	3600^b	3912^a	3758b	3853^a	6	1	3	1	5	2	2	3
Moti	3611^b	3867a^b	3376c^d	3704^a	5	2	4	2	3	1	4	2
Gebelcho	4011^a	3621b^c	4123^a	3422^b	1	3	1	4	2	3	1	1
Obsi	3298^b	34716^c	3290^d	3038^c	8	5	6	6	7	4	5	6
Dosha	3867^a	3376^d	3866a^b	3441^b	3	6	2	3	4	6	3	4
Tumsa	3672^a	3298^d	3321^d	3342^b	4	7	5	5	6	7	6	5
Gora	3891^a	3573c^d	3197^d	3004^c	2	4	7	7	1	5	7	7
Local check	1976^c	2213^e	2613^f	2333^d	9	9	9	9	8	9	8	8
GM	3499.9	3395.2	3401.7	3235.9	-	-	-	-	-	-	-	-
LSD(0.05)	354.7	273.1	258.6	228.8	-	-	-	-	-	-	-	-
CV	19.3	14.8	9.3	16.1	-	-	-	-	-	-	-	-

Discussion

It is a long time that Kulumsa Agriculture Research Centre (KARC) has been carried research activities to generate new production technologies, mainly genetically improved faba bean varieties as a national coordinator and collaborator in which more than 17 faba bean varieties are released nationally. Aside of a number of improved varieties, the adoptions and dissemination was very limited in Arsi. On the other hand a successful seed program that promotes, supplies sufficient quantity of high quality seed of adapted varieties on time and with reasonable cost remains a major constraint. This situation is much worse in faba bean compared to cereals such as wheat and barley in Arsi. In order to alleviate this problem, one approach that has been practiced, mainly in resource-poor farming communities, is faba bean Participatory Variety Selection (PVS) in different Arsi districts. Based on this study, farmers feedback were indicated as more benefited from faba bean participatory variety selection is an approach to provide choices of improved faba bean varieties to the participant farmers

for increasing production in their diversity of socioeconomic and agro-ecological conditions. They understand also as an opportunity to large number of improved faba bean varietal choices on their own resources and enhance all farmers' access to crop varieties and increase variety diversity. Besides, it allows varietal selection in targeted areas at cost-effective and also in less time, which helps for easy adoption and dissemination of released varieties in larger areas [6-8]. It is also a selection process of testing released or promising genotypes in farmer's field, includes research and extension methods to deploy genetic materials at on-farm experiment [8]. In other hand this study points out as gap that, the speed of improved faba bean variety dissemination, particularly in Arsi where farmers have access to produce other crops like wheat, which is easy to implement different available farm mechanizations. As a result, in most of the area farmers are practicing mono culture of wheat and face different production problems. Now market-oriented agricultural research and production is the policy of the Ethiopian government as the selected crops are used for industries and exports, there are openings where farmers can participate in aid of the selection process through highly client-oriented breeding [9-10]. In further, assessment of formal research methods for failure to produce appropriate technologies for resource-poor farmers, and "inappropriate" (not participatory/centralized) institutional structure of agricultural research has led to the initiation and developments of Farmers Participatory Research (FPR) approaches In overall, this faba bean participatory variety selection has been very successful both in facilitating adoption by poor farmers in all considered districts those are marginal environments of Arsi, not previously reached by formal plant breeding, and in understanding farmers' preference. This finding was more or less similar with that of [1,2]. and However, participatory variety selection lacks the cyclic nature of plant breeding with a continuous flow of genetic material from one stage to next, and it is not clear from the literature on participatory variety selection whether, how and when a farmer or a farmer community who have practiced participatory variety selection, will have another chance of participating in variety selection. Basically, participatory communication must meet in which researchers learn from farmers, not the other way round and talk with the farmers, not to the farmers.

Conclusion

The overall message of this finding was indicated faba bean participatory variety selection at the considered Arsi districts had a line share contribution towards enhancing food security and improved livelihood of small-scale farmers through increased faba bean production and productivity and increase awareness on improved varieties (for chosen) and dissemination through farmer-to-farmer seed exchange mechanisms. Particularly, an increased farmers' faba bean productivity and income as a result of availability of high yielding suitable varieties, that suit to farmers

selection criteria availed and there is also the capacity of the farmers and extension agents would be boosted on seed production that resulted income increment due to adoption of technologies and practices attributable to faba bean participatory variety selection intervention.

Future Direction

Each Improved faba bean variety selected at each district would be increased in a sustainable way to address all farmers of the areas in a revolving seed distribution system. The follow up of the researchers and agricultural experts of the districts were necessity for evaluation and popularization of the improved each selected faba bean varieties that help to produce a quality seed.

Acknowledgement

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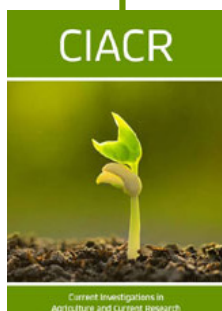
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